MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2015/2016**

## ECP 3136 – DIGITAL IMAGE PROCESSING

(BE)

8 OCTOBER 2015
9.00 a.m – 11.00 a.m
(2 Hours)

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**INSTRUCTIONS TO STUDENTS**

1. This Question Paper consists of five pages including the cover page.
2. Attempt **ALL FOUR** questions. Each question carries 25 marks and the distribution of the marks for each question is given.
3. Write all your answers in the Answer Booklet provided.

## QUESTION 1

a) Explain what is meant by scotopic and photopic vision. In your answer state the retinal cells that are active in each of the cases. [6 marks]

b) Explain the image pixel replication interpolation method. State the advantages and disadvantages of this technique. [6 marks]

c) Magnify the image in Figure Q1a twice by using the pixel replication interpolation method. [6 marks]

| | | | | |
|---|---|---|---|---|
| | 0 | 1 | 1 | q |
| | 2 | 5 | 3 | |
| p | 1 | 2 | 1 | |

**Figure Q1a**

d) For the image in Figure Q1a where adjacency of pixels is defined by the set V = {1,2}, identify the types of adjacency and calculate the chessboard distance, D8 between pixels p and q. [3+4 marks]

## QUESTION 2

**Figure Q2a**

**Figure Q2b**

**Figure Q2c**

**Continued .....**

a) Figures Q2b and Q2c show images after enhancement by the power law transformation of the image in Figure Q2a with Gamma values of 0.7 and 4. By using the transformation map for $\gamma$ shown in Figure Q2d, explain which Gamma value was used in Q2b and Q2c. [ 2 marks]

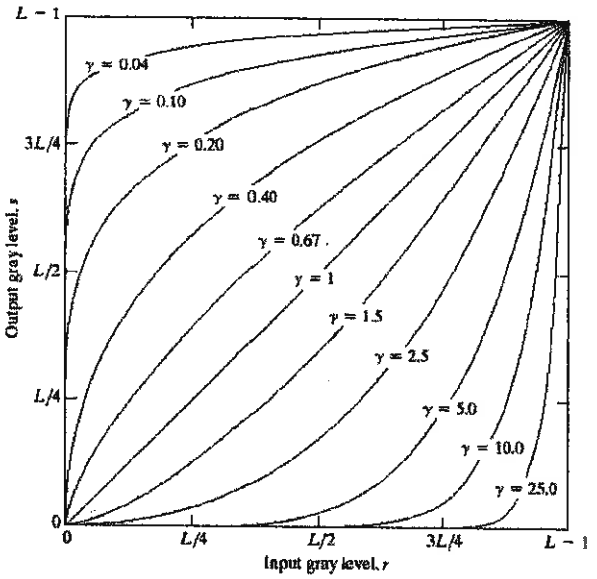
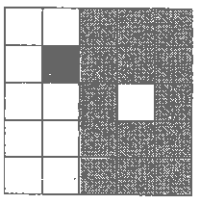



**Figure Q2d**

b) What is meant by salt-and-pepper noise in an image? Using the image in Figure Q2e, and the corresponding pixel values given shown in the matrix, explain how a 3 × 3 median filter will eliminate the salt-and-pepper noise in the image. What is the advantage of the median filter compared to an averaging filter?



$$\begin{bmatrix} 255 & 255 & 128 & 128 & 128 \\ 255 & 0 & 128 & 128 & 128 \\ 255 & 255 & 128 & 255 & 128 \\ 255 & 255 & 128 & 128 & 128 \\ 255 & 255 & 128 & 128 & 128 \end{bmatrix}$$

**Figure Q2e**

[ 2+4+1 marks]

**Continued...**

c) Define an edge in images. Provide examples for gradient and Laplacian masks used for edge detection. How do first order and second order masks compare in edge detection?

[1 + 6 + 2 marks]

d) Explain using suitable steps, how you would detect and count the number of human figures crossing a road from a given frame in a video recording.

[7 marks]

**QUESTION 3**

a) What is meant by image segmentation and what is its purpose? What are the three general methods for image segmentation? Discuss three goals of a good image segmentation.

[4+3+3 marks]

b) The segmentation methods based on the detection in sharp, local changes in intensity use first and second order derivatives.

i. Which derivative is suitable for determining an isolated point? Sketch a suitable mask for this case. [2+3 marks]

ii. Sketch suitable masks for determining horizontal, diagonal and vertical lines.

[2+2+2 marks]

c) Explain the terms region growing and region aggregation in image segmentation.

[2+2 marks]

**Continued ...**

## QUESTION 4

a) A popular scheme for representation of binary three-dimensional images is to use octrees. Describe the representation scheme, and explain why this type of representation is preferable as compared to normal three-dimensional matrix representation.

[13 marks]

a) Ultrasonic systems are used for medical imaging. Discuss the following:

i. The working principles of Ultrasonic imaging systems. [6 marks]

ii. The risks of using Ultrasound? [4 marks]

iii. Two types of Ultrasound systems. [2 marks]

**End of Page**